EurEnDel. Results of the 1. survey round - Graphical display of the raw data of the first survey round

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Results of the 1st survey round –

Graphical display of the raw data of the first survey round

A working paper by

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February 1st 2004

About this document

This document summarizes the raw data gained in the first round of the European Energy Delphi – EurEnDel survey. It basically consists of graphs, which where used in the on-line questionnaire of the second Delphi round. As it does not include any general information on the project itself, neither in-depth evaluations nor interpretations of the data, it should only be considered as a working document.

It is meant as a small sign of our gratitude towards those experts who spent much time and effort on filling in the EurEnDel questionnaire. We hope that this quick feedback on the results of the first round will be helpful for your work also. Further documentations will follow as the project proceeds.

On behalf of the EurEnDel team

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for more information on the EurEnDel project, visit the project website:

www.eurendel.net

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Contents

Following the outline of the EurEnDel questionnaire, this document consists of a first section with 18 technological Delphi statements and the expert responses towards time of occurrence, impact of the development represented by the statement, and an assessment of actions, which would be needed to enhance the likelihood of the occurrence of the statement. In the second section of the questionnaire normative visions were given and the experts were asked to assess which energy sources or technologies and which other innovations or instruments are most fit to support each vision.

Shown in the graphs of this document are always the percentages of the experts rating for each variable. Not included are the numerous comments, given by the experts for each of the Delphi-statement, and the three of the visions, nor the answers to the question on wild cards of the energy system.

Definitions

(as given in the questionnaire)

Level of expertise

Expert - if you consider yourself to belong to that community of people who currently dedicate themselves to this topic.

Knowledgeable - a. if you were an expert in it some time ago, but feel somewhat rusty now; b. if you are in the process of becoming an expert but still have some way to go to achieve mastery of the topic; c. if you work in a neighbouring field and occasionally draw upon or contribute to the development of this topic.

Familiar - if you know most of the arguments used in discussions on the topic, you have read about it, and have formed an opinion about it.

Degree of impact

Wealth creation is defined as the economic growth of the European economy measured in GNP/capita.

Environment is defined as the natural environment, biological diversity, air and water.

Quality of life is defined as major advancement in health and safety, education, employment, affordable housing, and cultural and recreational opportunities for most people.

Security of supply is defined as robustness of security of energy supply to ensure that European citizens are not exposed to shortages of energy supply and that Europe is not affected by international policy and conflicts in this area.

Other

Practical use: the first practical use of an innovative product or service

Widespread use: market penetration to a level where a product or service is in common us

Technological breakthrough: development of new technical devices and processes that result in revolutionary improvements in capability of single technologies or whole technological fields.

Wild cards: We define technological wildcards as major innovations or technological breakthroughs, which would have a relatively low chance of occurrence, but would have a severe impact on the energy system as a whole.

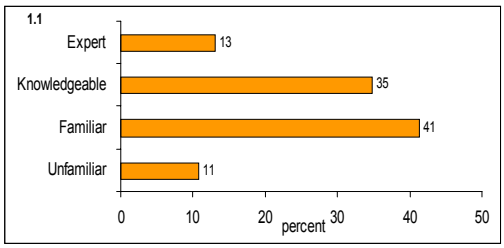
Section 1: Technological statements

List of statements:

Demand	
1	Industrial energy consumption in Europe is reduced by 50% per produced unit through novel production processes
2	Low-energy buildings with intelligent power systems make up >50% of all new buildings in Europe
Transport	
3	Fuel cell driven cars reach a European market share of 20%
4	Bio-fuels will have a European market share of >25% in the road transport sector
5	Improved logistics based on information and communication technologies raise the railway's market share in Europe's freight transport to 15% [1990: 11%, today: 8%].
Storage and Distribution	
6	Hydrogen used as an energy carrier constitutes a significant part of the energy system (transport and stationary application)
7	Advanced energy storage technologies are widely used in renewable energy supply systems
8	Liquefied Natural Gas terminals and advanced high-pressure pipeline systems permit to multiply Europe's gas imports by 10 [EU-15 demand 1999 is 386 bcm (billion cubic meters); 40% imported]
9	Widespread use of superconductive materials in transformers and generators
Supply	
10	Distributed energy systems (< 10 MW) contribute with >30% to Europe's electricity supply [Today it is 14%]
11	Large international grids allow an energy production based on regional renewables (solarthermal power from North Africa, biomass from Central Europe etc.)
12	Plasma confinement technologies for nuclear fusion are in practical use
13	Nuclear power plants based on passive safe reactor types are in practical use
14	Renewable energy sources cover 25% of Europe's total energy supply [Today it is 6%]
15	Photovoltaic cells contribute with >5% of European electricity generation [Today it is 0.15%]
16	Ocean technologies (e.g. tidal, currents, and wave) are in practical use
17	Biomass for central heating and district heating systems is widely used
18	CO2 capture and sequestration from fossil fuel power plants is in practical use

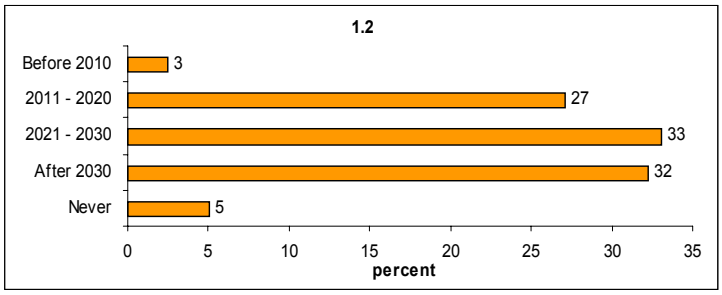
1. Statement: Industrial energy consumption in Europe is reduced by 50% per produced unit through novel production processes

1.1 Expertise of respondents

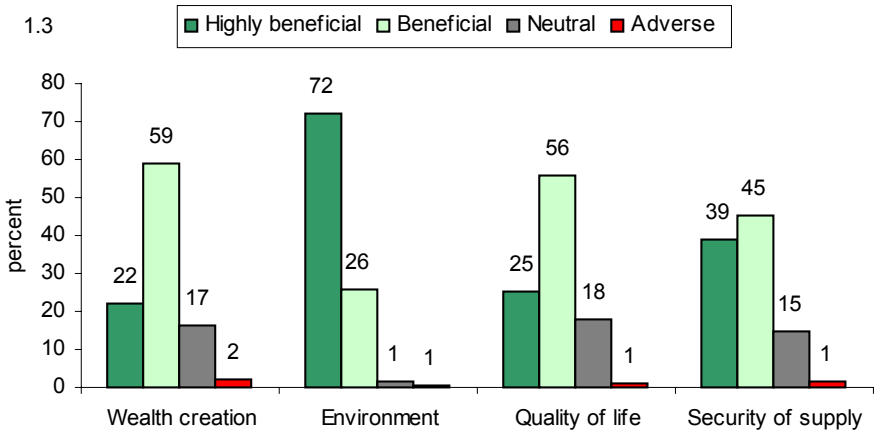


Number of respondents on this statement: N=649

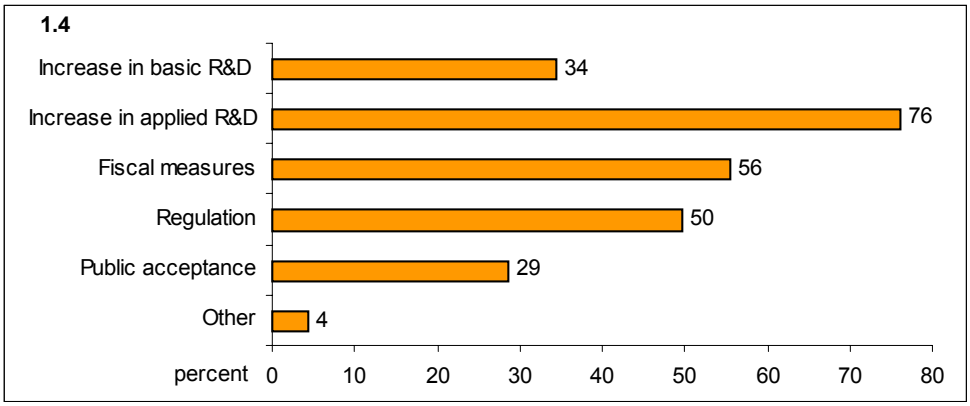
1.2 Assessment of time of occurrence



1.3 Assessment of Impact

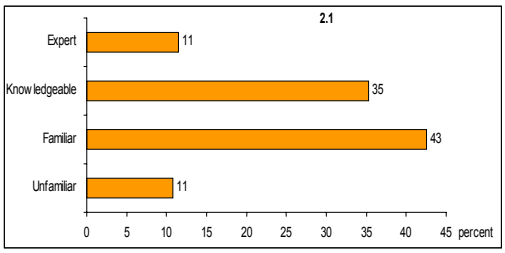


1.4 Actions needed to enhance likelihood of occurrence



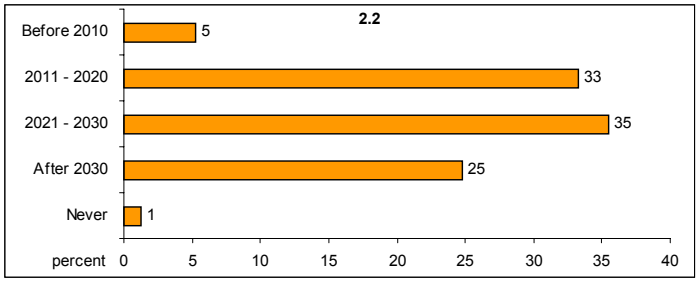
2. Statement: Low-energy buildings with intelligent power systems make up >50% of all new buildings in Europe

2.1 Expertise of respondents

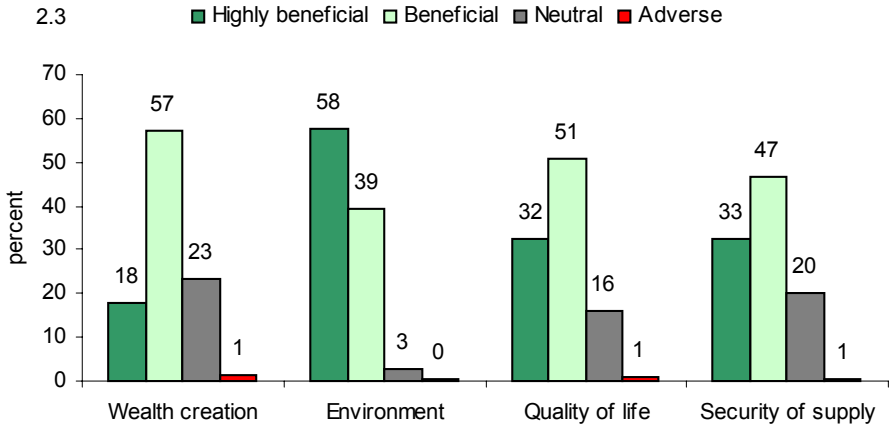


Number of respondents on this statement: N=647

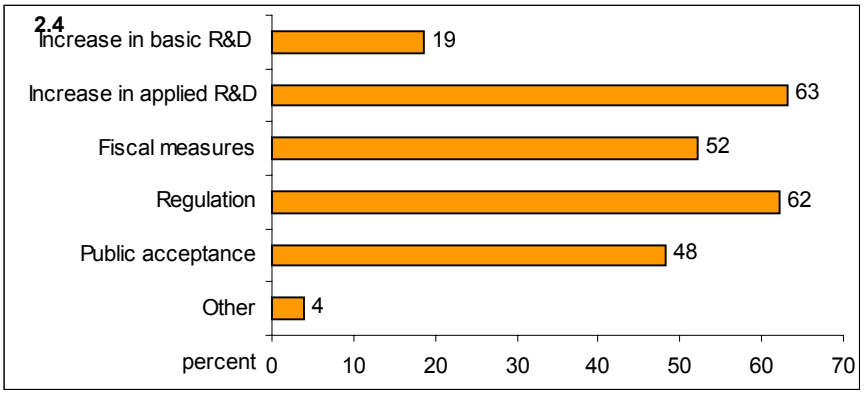
2.2 Assessment of time of occurrence



2.3 Assessment of Impact

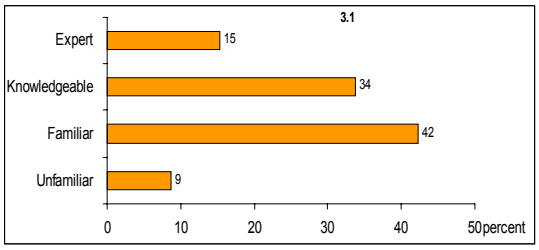


2.4 Actions needed to enhance likelihood of occurrence



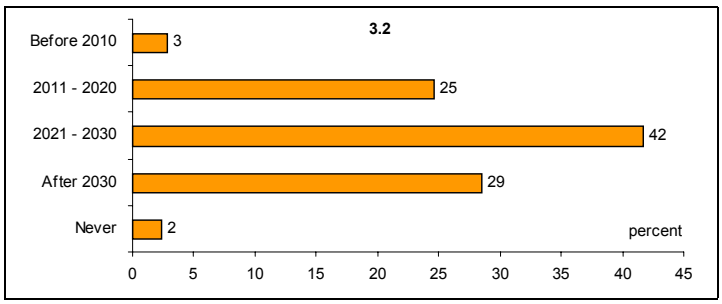
3. Statement: Fuel cell driven cars reach a European market share of 20%

3.1 Expertise of respondents

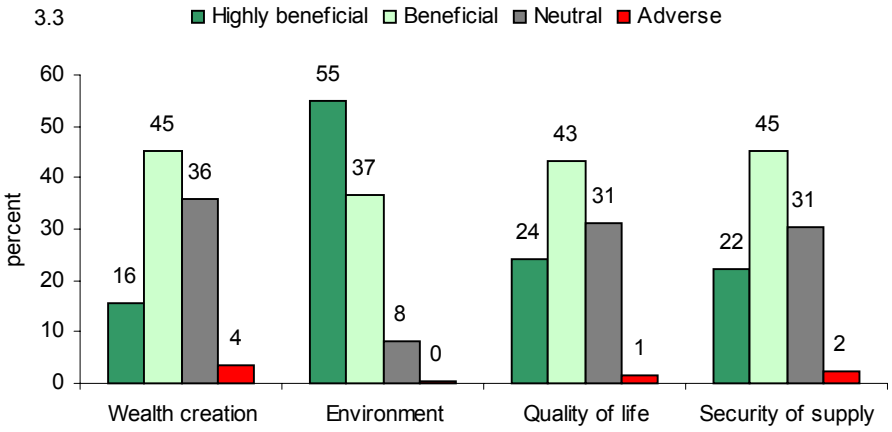


Number of respondents on this statement: N=648

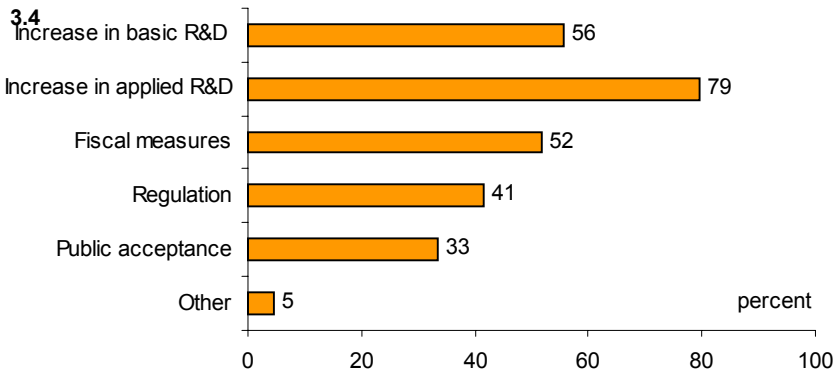
3.2 Assessment of time of occurrence



3.3 Assessment of Impact

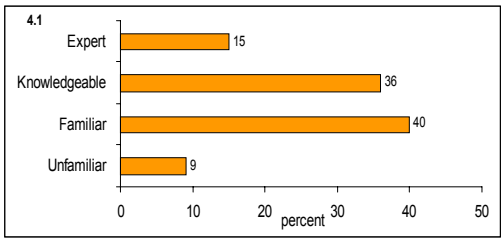


3.4 Actions needed to enhance likelihood of occurrence



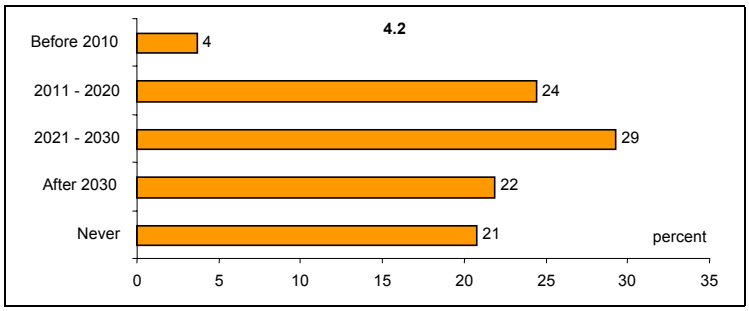
4. Statement: Bio-fuels will have a European market share of >25% in the road transport sector

4.1 Expertise of respondents

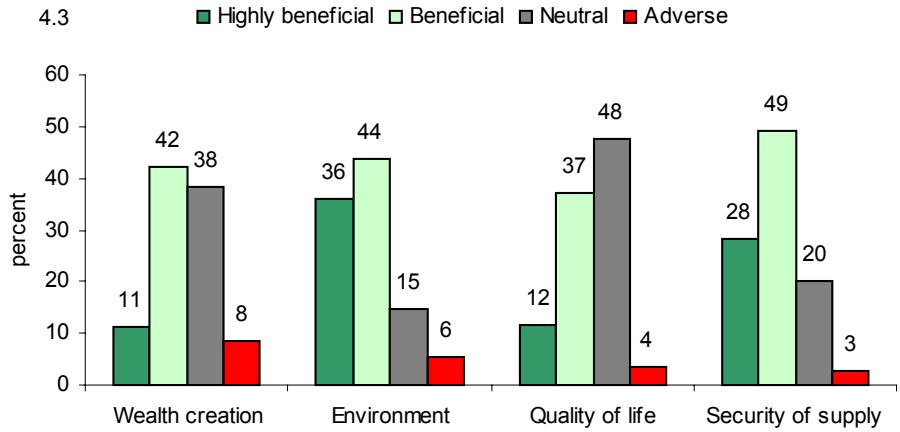


Number of respondents on this statement: N=637

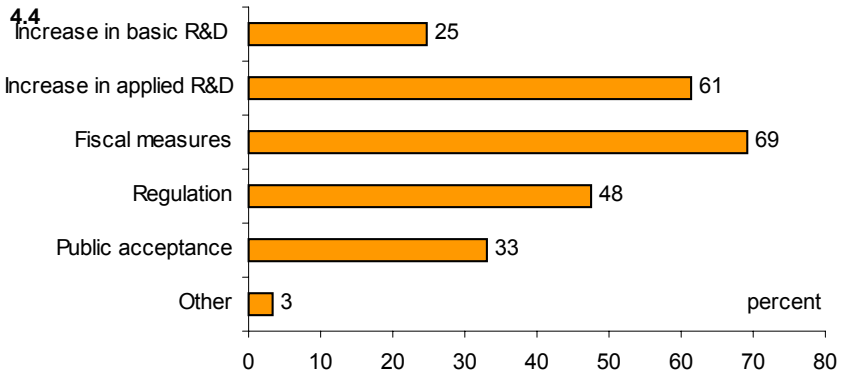
4.2 Assessment of time of occurrence



4.3 Assessment of Impact

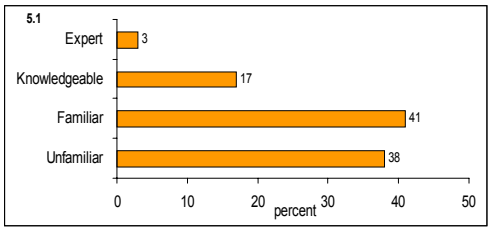


4.4 Actions needed to enhance likelihood of occurrence



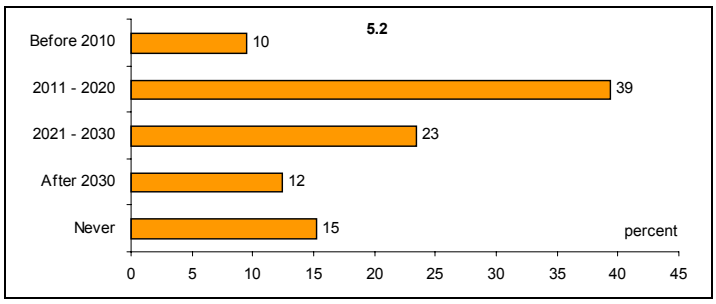
5. Statement: Improved logistics based on ICT raise the railway's market share in Europe's freight transport to 15% [1990: 11%, today: 8%]

5.1 Expertise of respondents

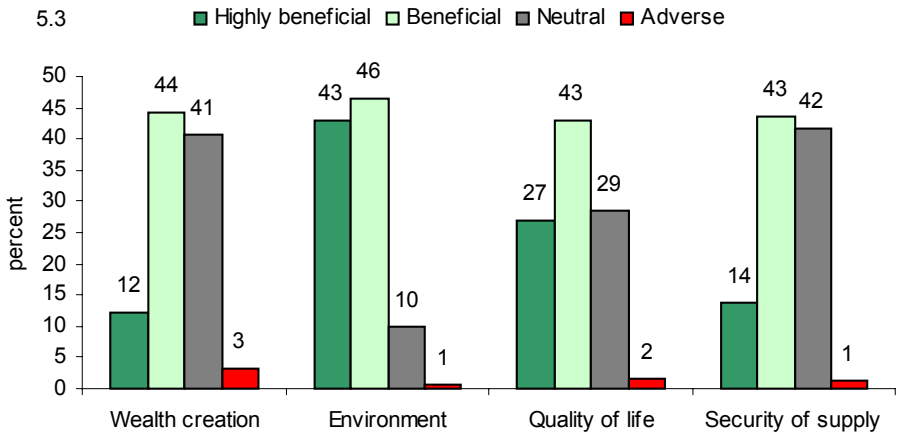


Number of respondents on this statement: N=633

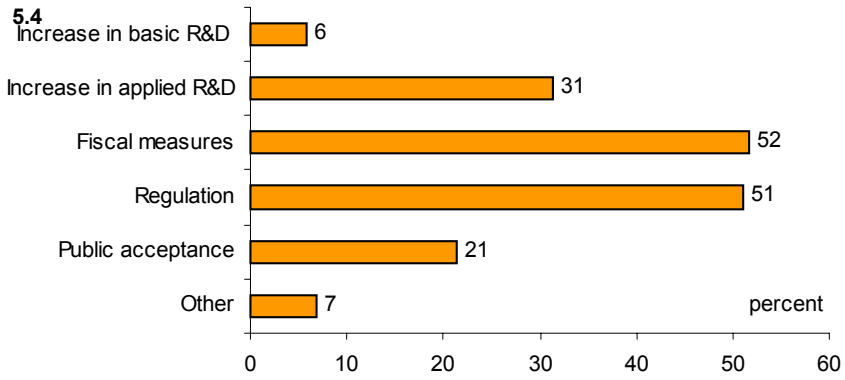
5.2 Assessment of time of occurrence



5.3 Assessment of Impact

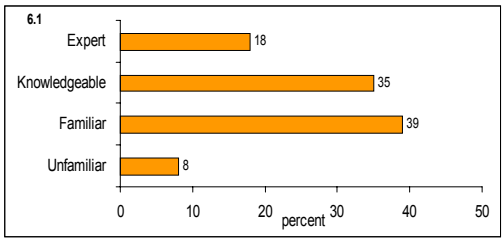


5.4 Actions needed to enhance likelihood of occurrence



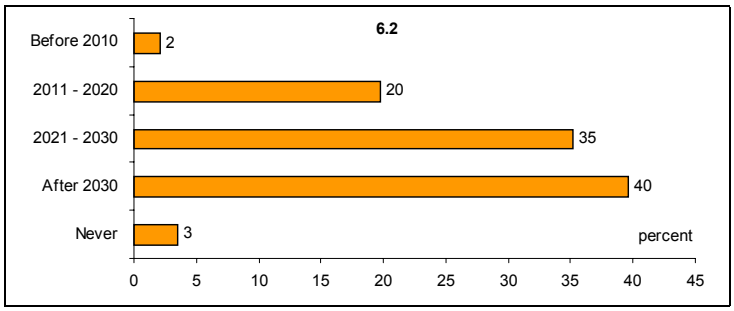
6. Statement: Hydrogen produced used as an energy carrier constitutes a significant part of the energy system

6.1 Expertise of respondents

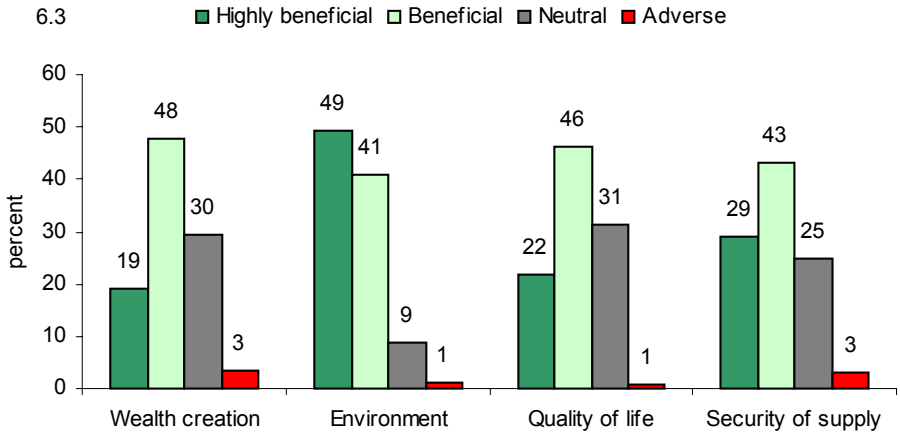


Number of respondents on this statement: N=648

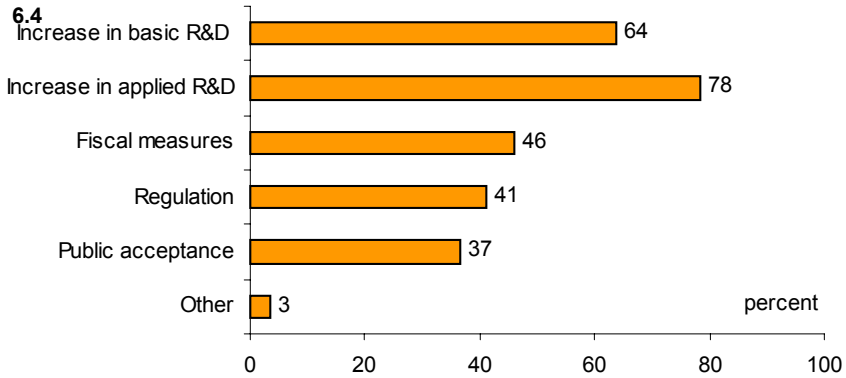
6.2 Assessment of time of occurrence



6.3 Assessment of Impact

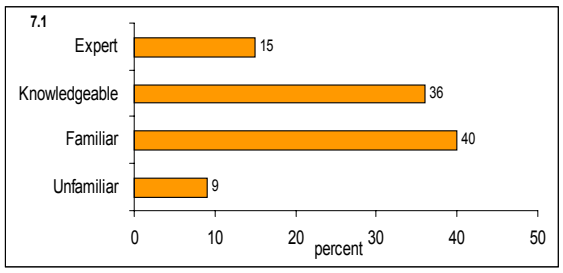


6.4 Actions needed to enhance likelihood of occurrence



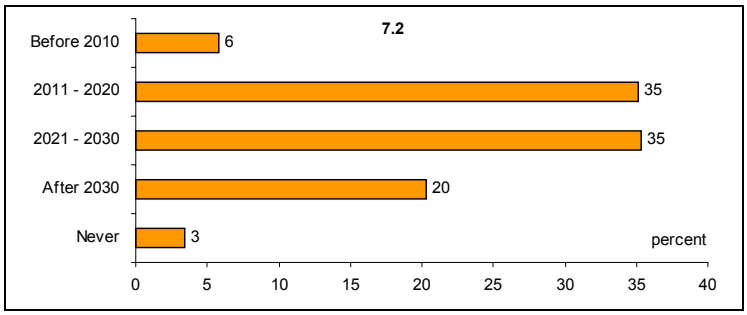
7. Statement: Advanced energy storage technologies are widely used in renewable energy supply systems

7.1 Expertise of respondents

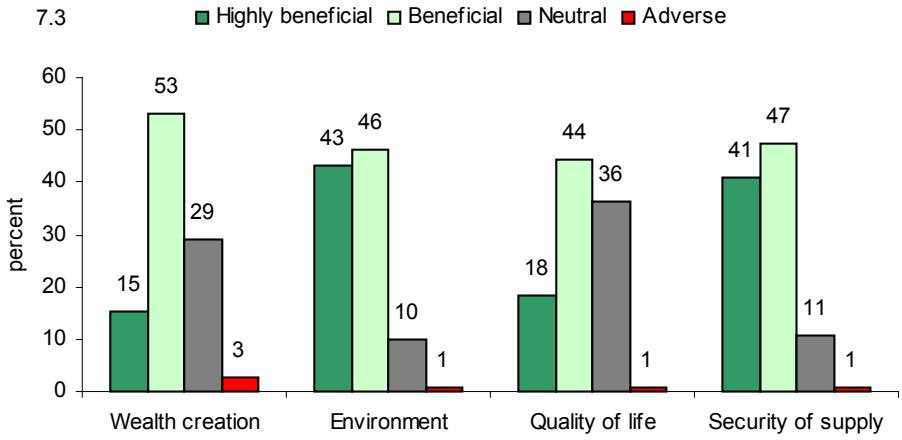


Number of respondents on this statement: N=637

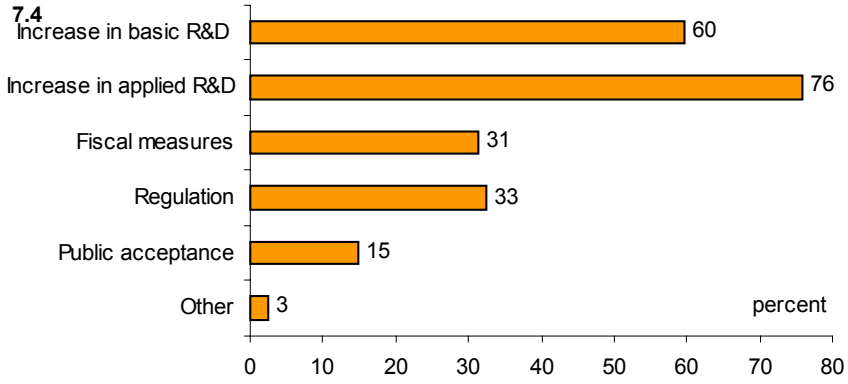
7.2 Assessment of time of occurrence



7.3 Assessment of Impact

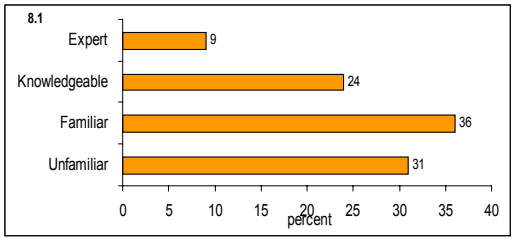


7.4 Actions needed to enhance likelihood of occurrence



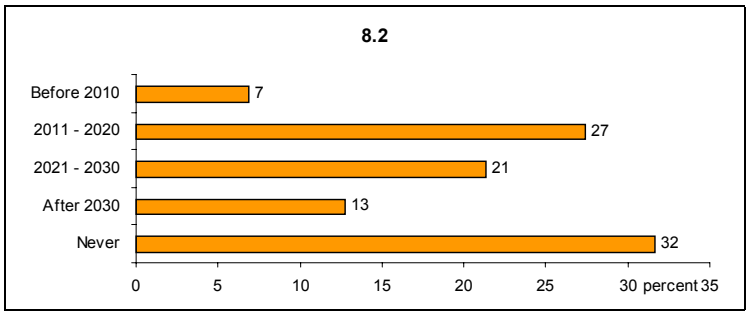
8. Statement: Liquefied natural gas terminals and advanced high-pressure pipeline systems permit to multiply Europe's gas imports by 10

8.1 Expertise of respondents



Number of respondents on this statement: N=630

8.2 Assessment of time of occurrence



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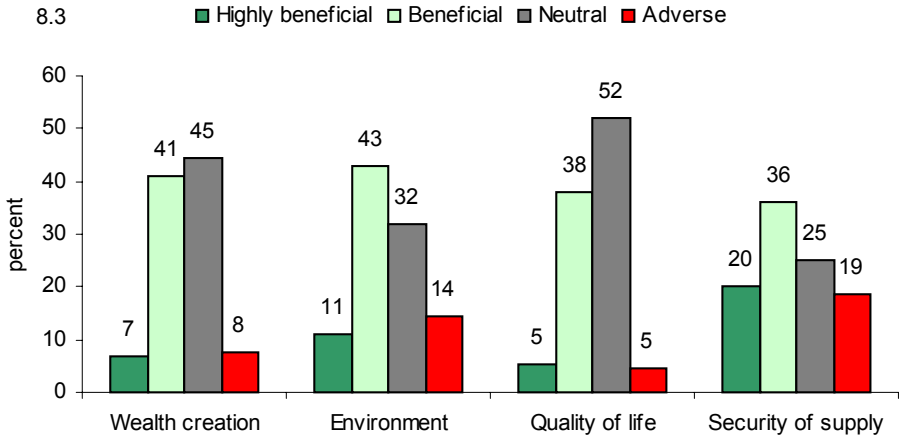
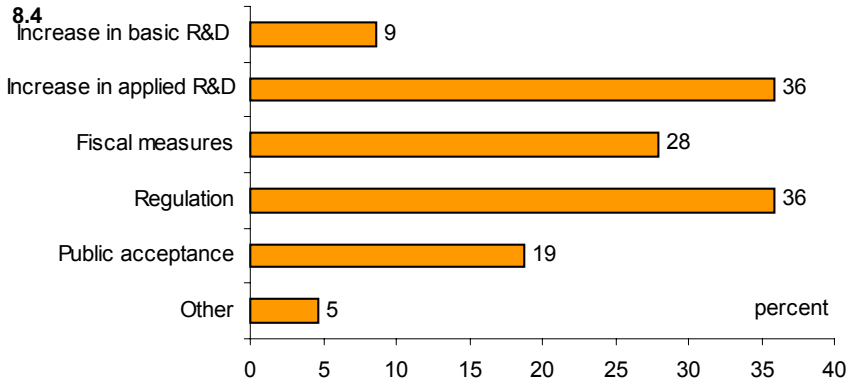
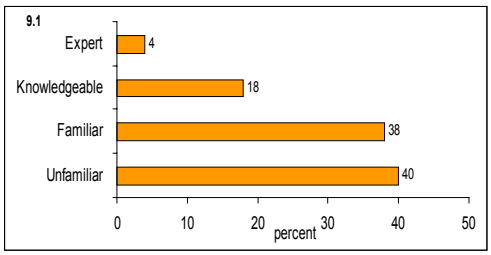


8.4 Actions needed to enhance likelihood of occurrence



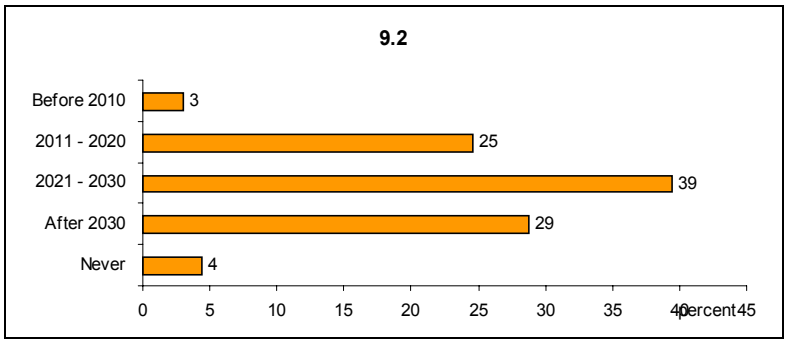
9. Statement: Widespread use* of superconductive materials in transformers and generators

9.1 Expertise of respondents

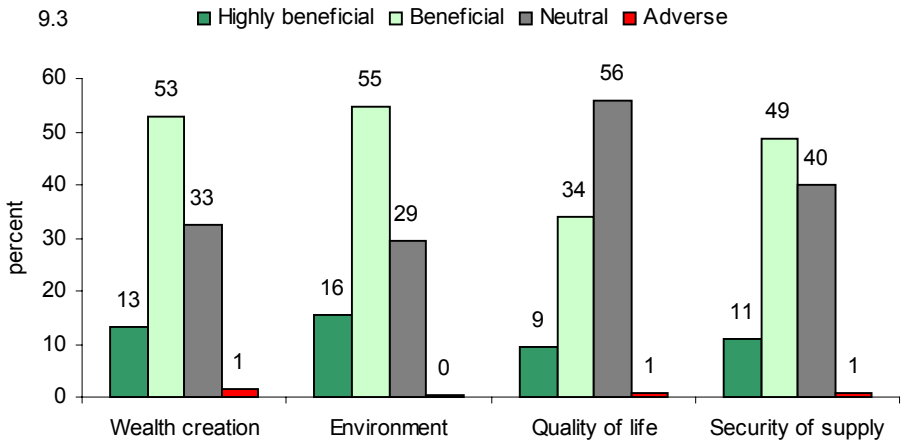


Number of respondents on this statement: N=630

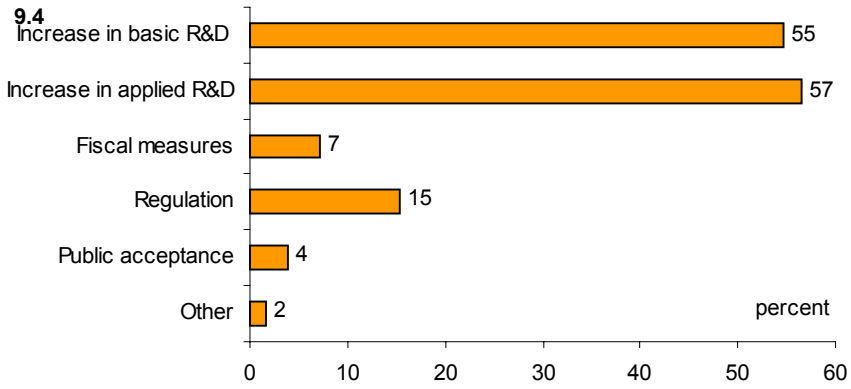
9.2 Assessment of time of occurrence



9.3 Assessment of Impact

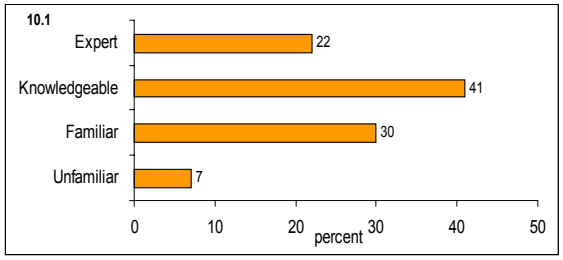


9.4 Actions needed to enhance likelihood of occurrence



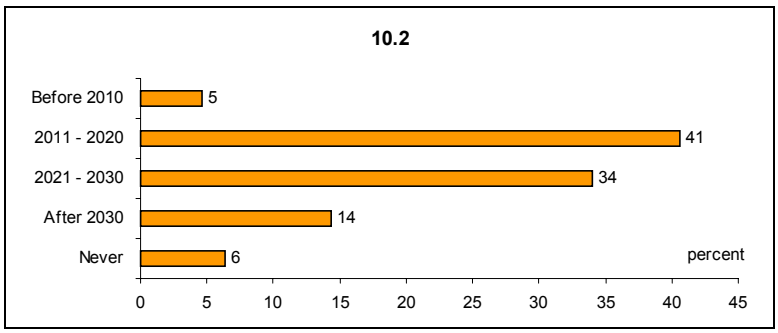
10. Statement: Distributed energy systems (< 10 MW) contribute with >30% to Europe's electricity supply [Today it is 14%]

10.1 Expertise of respondents

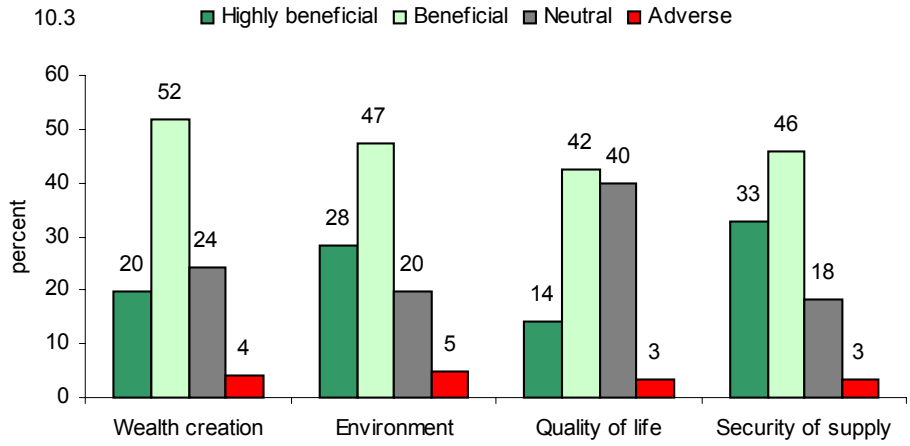


Number of respondents on this statement: N=637

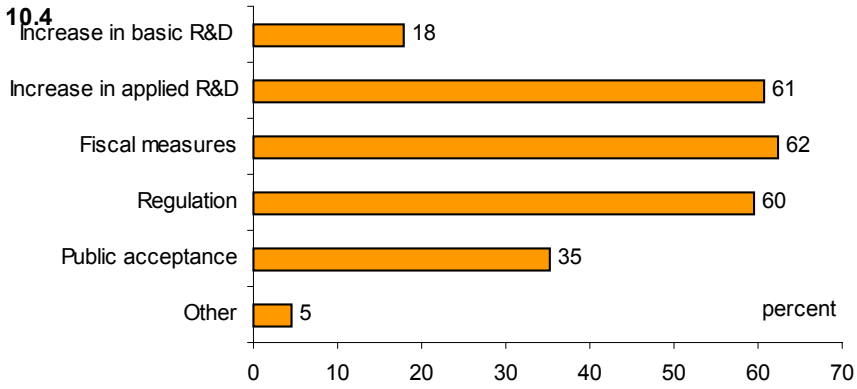
10.2 Assessment of time of occurrence



10.3 Assessment of Impact

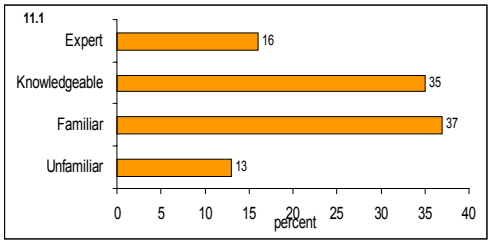


10.4 Actions needed to enhance likelihood of occurrence



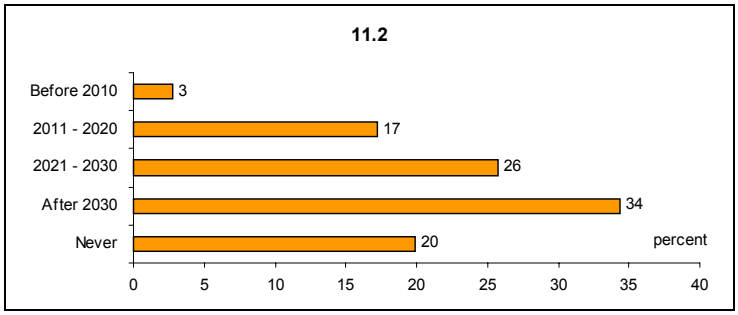
11. Statement: Large international grids allow an energy production based on regional renewables (solarthermal power from North Africa, biomass from Central Europe etc.)

11.1 Expertise of respondents

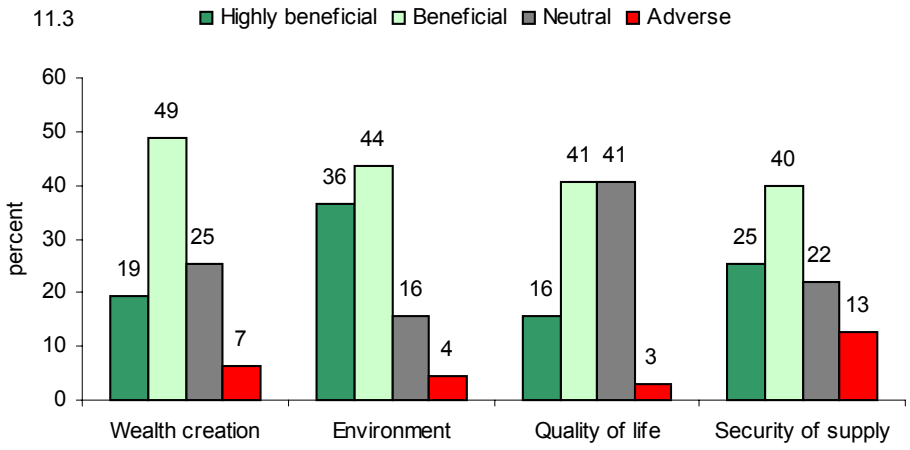


Number of respondents on this statement: N=640

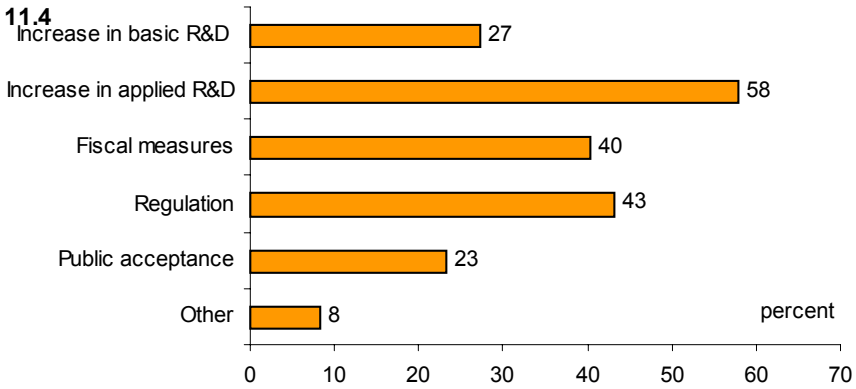
11.2 Assessment of time of occurrence



11.3 Assessment of Impact

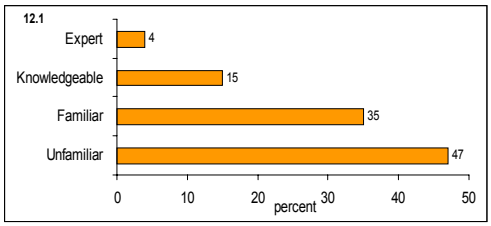


11.4 Actions needed to enhance likelihood of occurrence



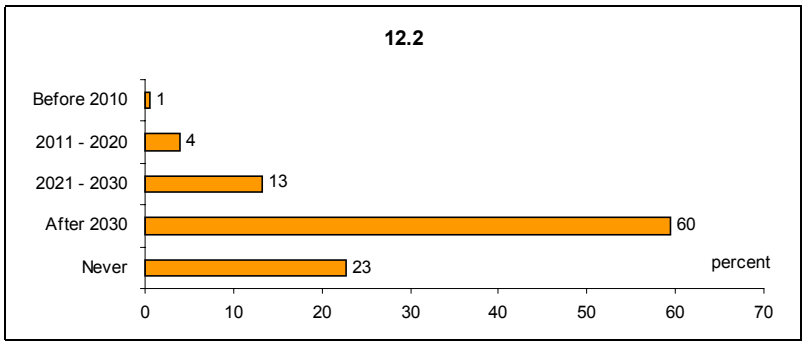
12. Statement: Plasma confinement technologies for nuclear fusion are in practical use*

12.1 Expertise of respondents

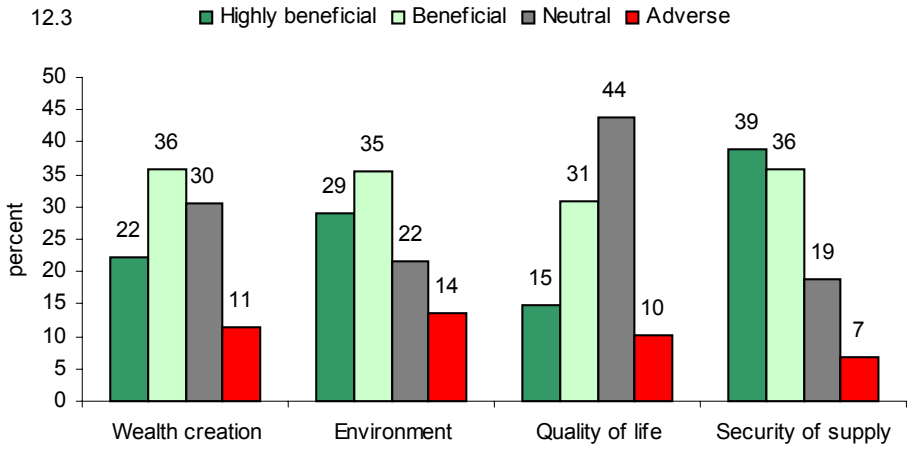


Number of respondents on this statement: N=628

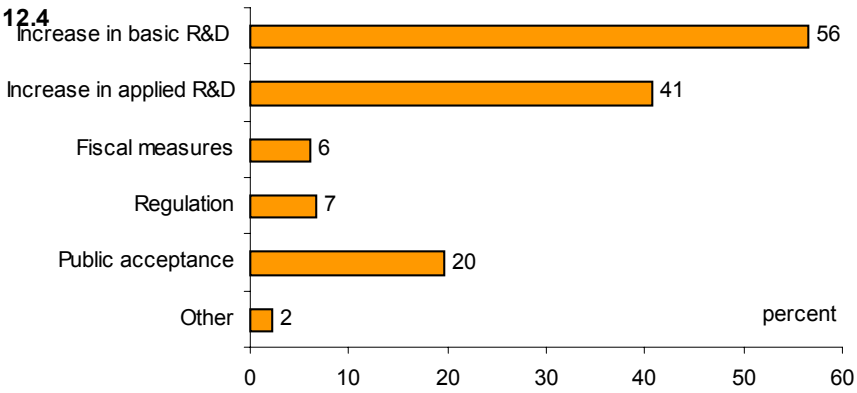
12.2 Assessment of time of occurrence



12.3 Assessment of Impact

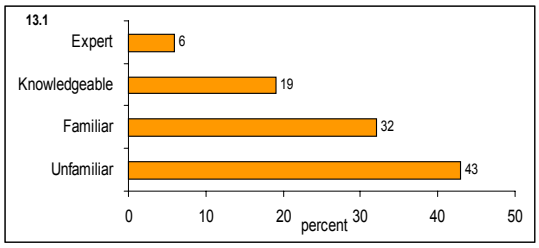


12.4 Actions needed to enhance likelihood of occurrence



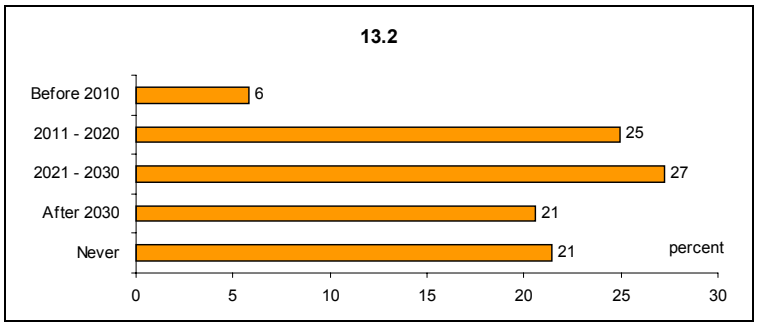
13. Statement: Nuclear power plants based on passive safe reactor types are in practical use

13.1 Expertise of respondents

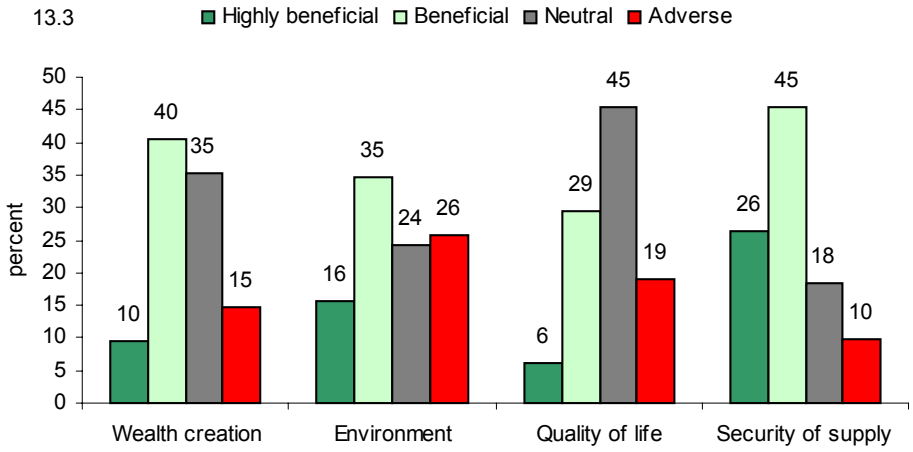


Number of respondents on this statement: N=628

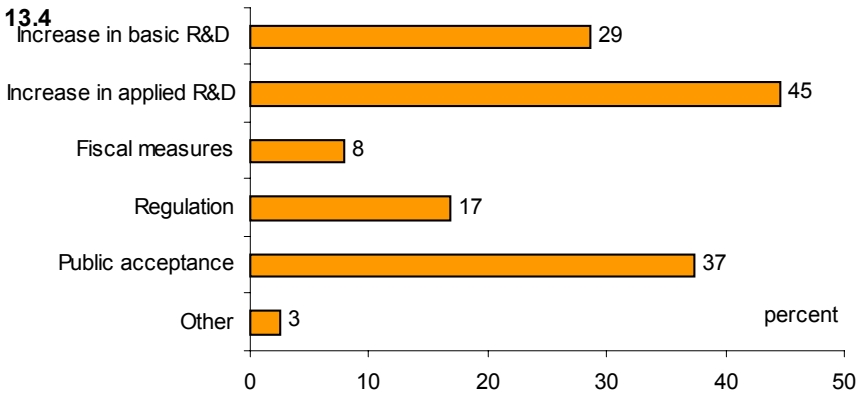
13.2 Assessment of time of occurrence



13.3 Assessment of Impact

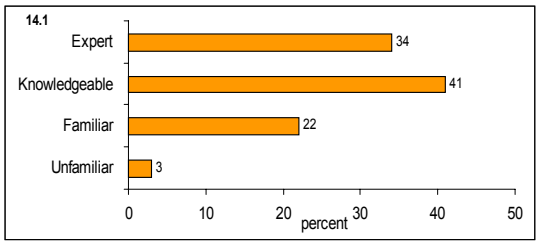


13.4 Actions needed to enhance likelihood of occurrence



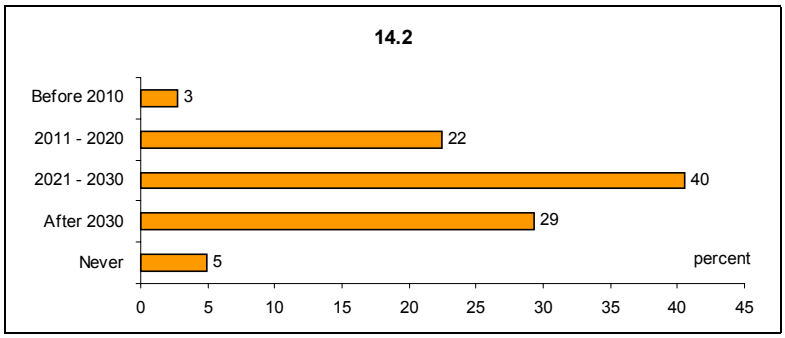
14. Statement: Renewable energy sources cover 25% of Europe's total energy supply [Today it is 6%]

14.1 Expertise of respondents

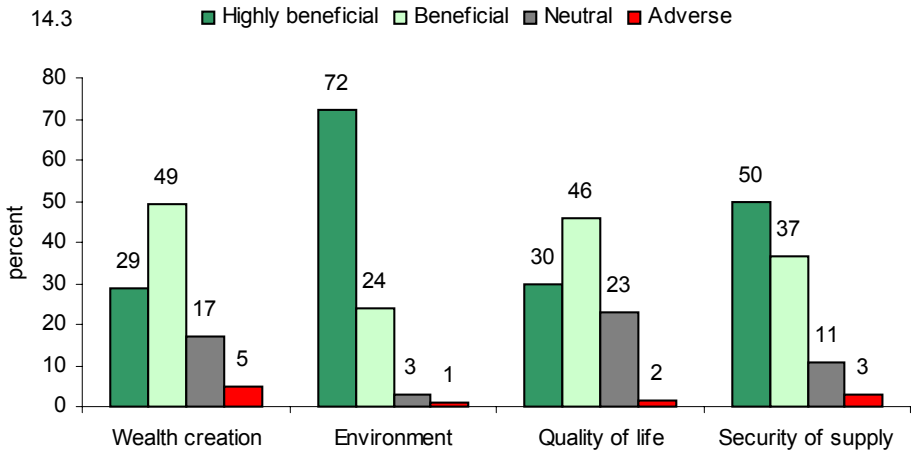


Number of respondents on this statement: N=632

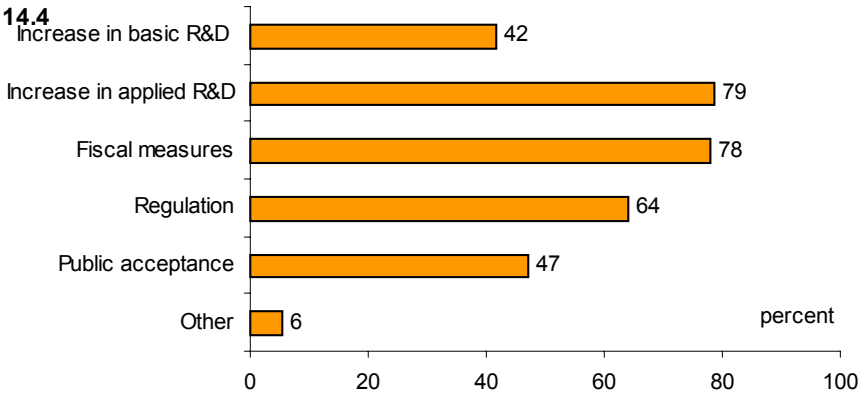
14.2 Assessment of time of occurrence



14.3 Assessment of Impact

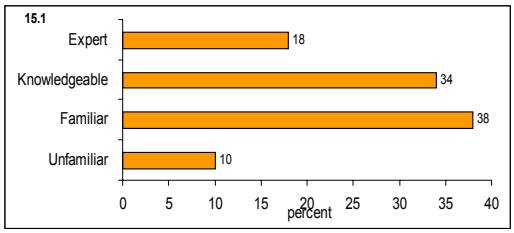


14.4 Actions needed to enhance likelihood of occurrence



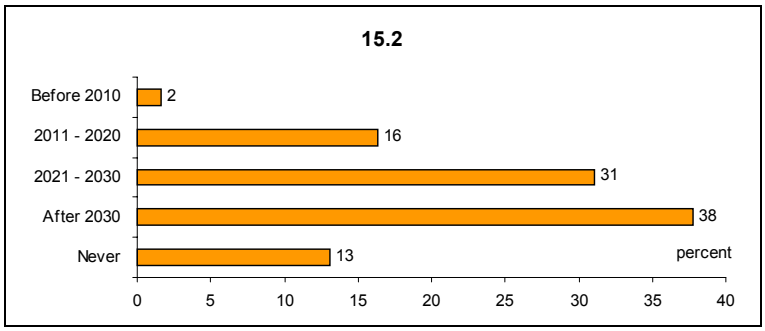
15. Statement: Photovoltaic cells contribute with >5% of European electricity generation [Today it is 0.15%]

15.1 Expertise of respondents

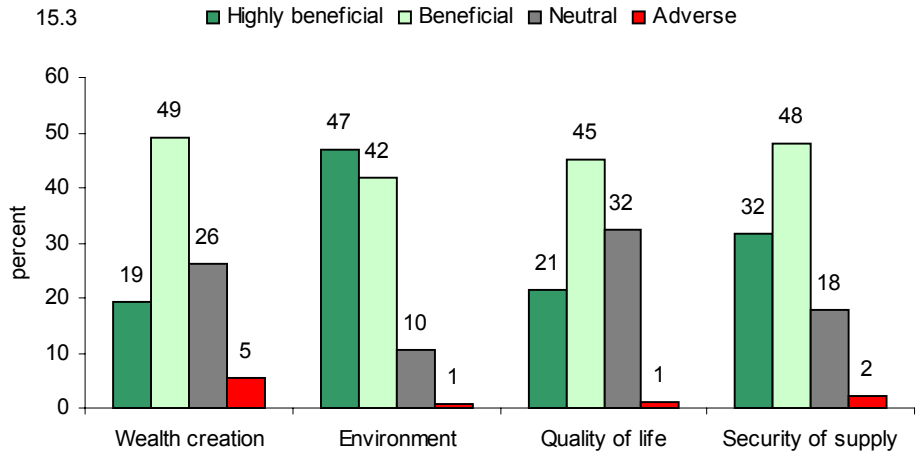


Number of respondents on this statement: N=635

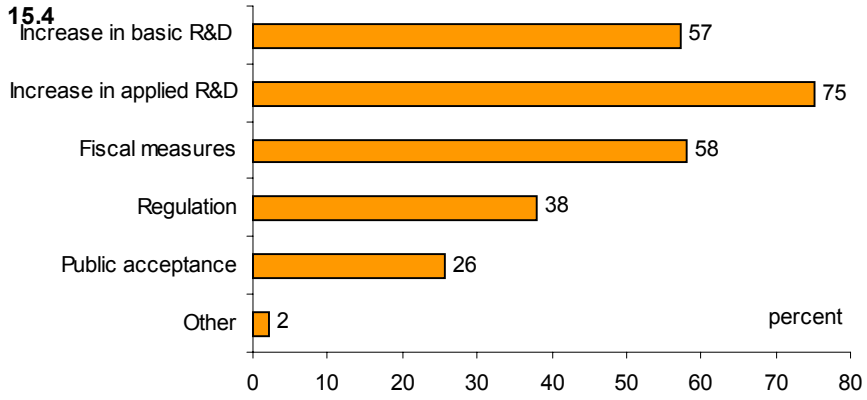
15.2 Assessment of time of occurrence



15.3 Assessment of Impact

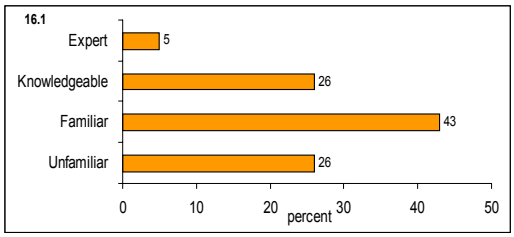


15.4 Actions needed to enhance likelihood of occurrence



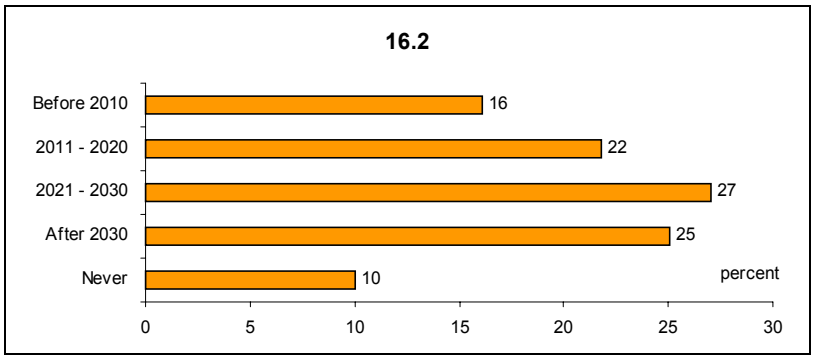
16. Statement: Ocean technologies (e.g. tidal, currents, and wave) are in practical use

16.1 Expertise of respondents

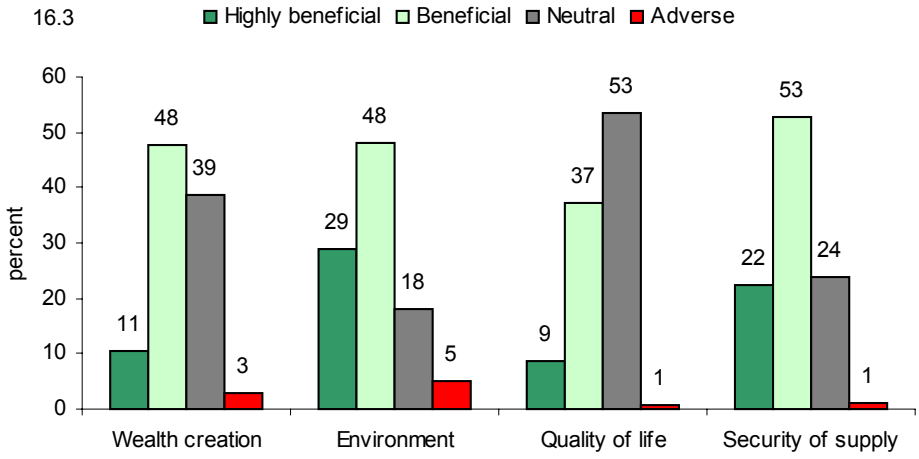


Number of respondents on this statement: N=631

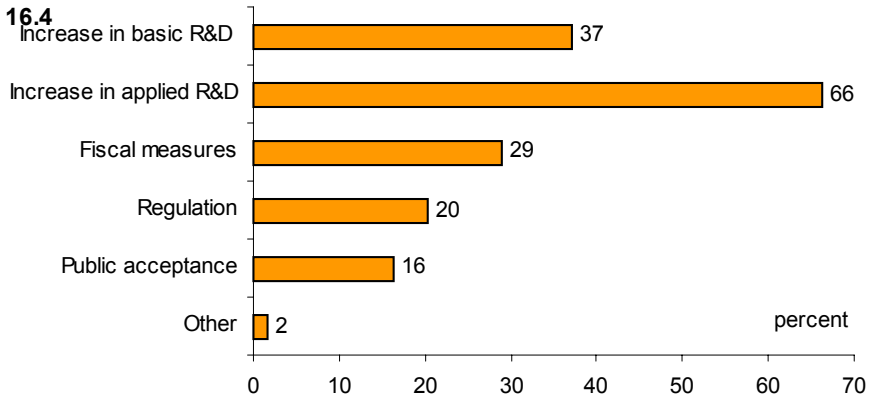
16.2 Assessment of time of occurrence



16.3 Assessment of Impact

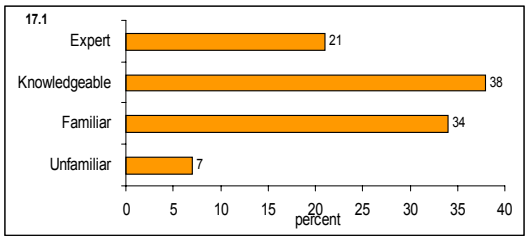


16.4 Actions needed to enhance likelihood of occurrence



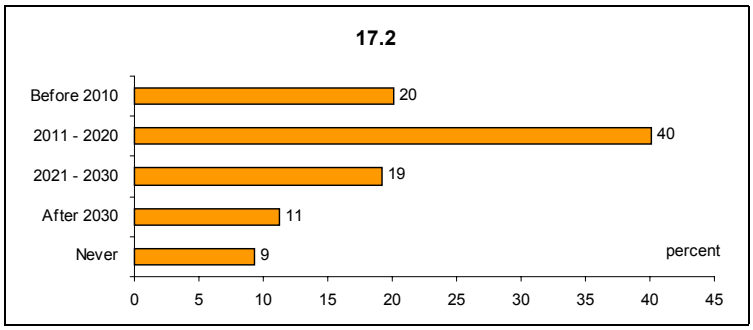
17. Statement: Biomass for central heating and district heating systems is widely used

17.1 Expertise of respondents

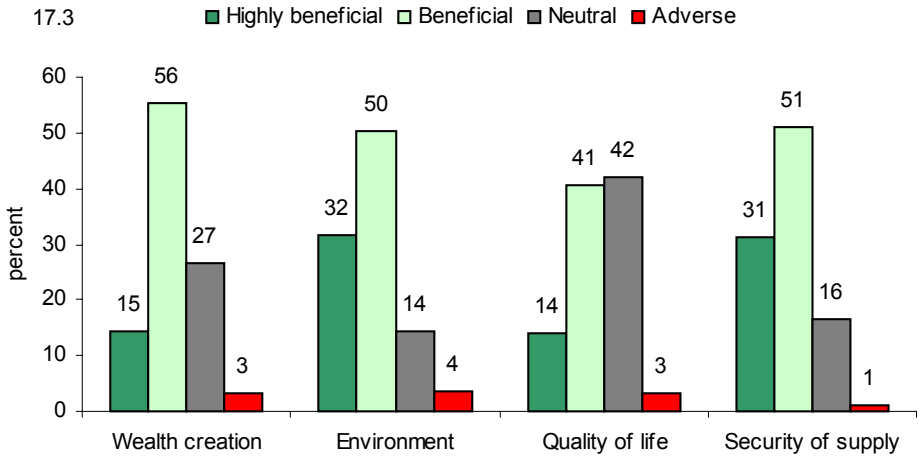


Number of respondents on this statement: N=635

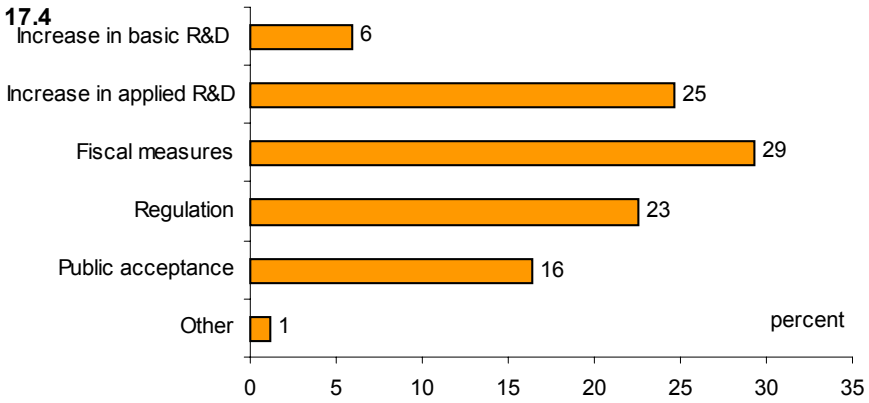
17.2 Assessment of time of occurrence



17.3 Assessment of Impact

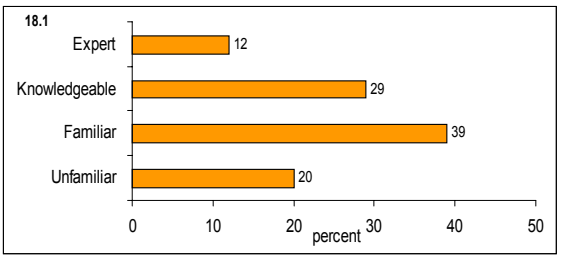


17.4 Actions needed to enhance likelihood of occurrence



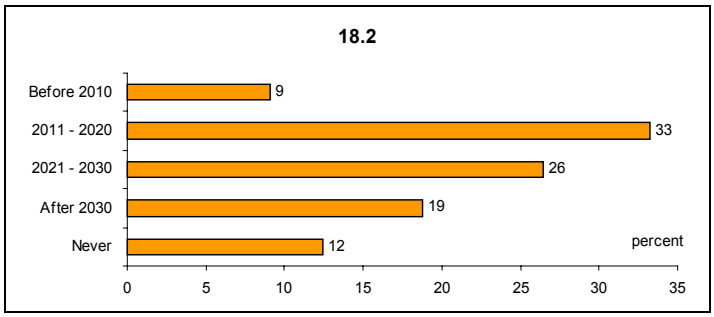
18. Statement: CO2 capture and sequestration from fossil fuel power plants is in practical use

18.1 Expertise of respondents

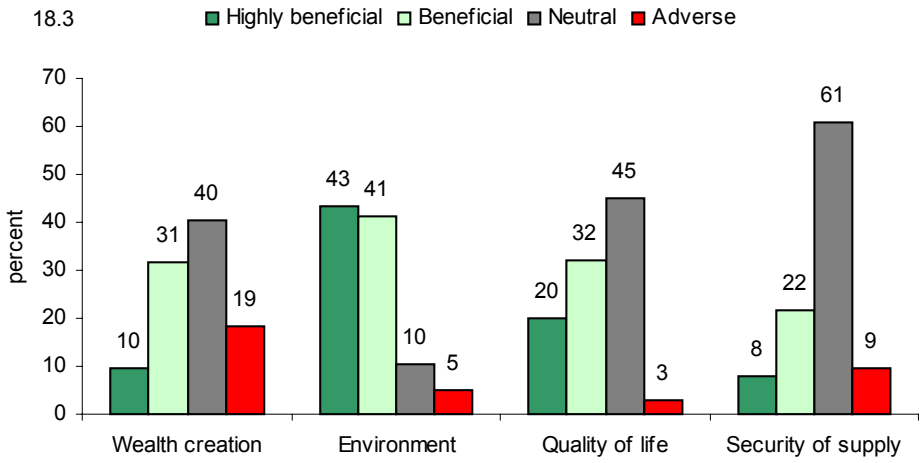


Number of respondents on this statement: N=633

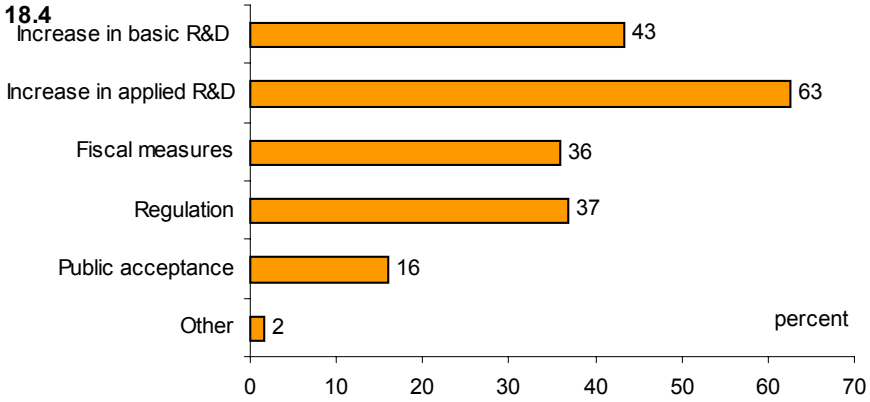
18.2 Assessment of time of occurrence



18.3 Assessment of Impact



18.4 Actions needed to enhance likelihood of occurrence



Section 2: Societal Visions

1. Vision – Individual Choice

The social vision

2030: Individual liberty is the prime societal value in Europe. Consequently politics set the framework for liberalised markets with a strong emphasis on consumers' sovereignty. Transparency of costs and free competition ensure that people have the possibility to choose products and services according to their individual needs and personal preferences. The portfolio ranges from low-cost fulfilment of basic needs to high comfort or ecological products at high costs.

Consequences for the energy sector

Tailor made energy solutions for individual needs

Energy companies are offering tailor made product and service combinations. They include "no worry" packages from multi utilities as well as very specialised solutions, which are tailored to the needs of individual customers:

High demand for low cost energy - to satisfy basic needs

Standardized "mass market" energy solutions are available at low cost. This holds true especially for urban areas and economically prosperous regions. The strong competition in industry calls for a great amount of low cost energy.

Robust energy supply - for those who are willing to pay more

Security of supply, understood as robustness and flexibility of the system, is highly valued, as interruptions would heavily limit the individual's freedom of choice. However guarantied unlimited supply at peak load times is very costly. Companies that have very high and specific demands in terms of security of supply have to sign expensive 'premium power' contracts, employ short term back-up systems or run decentralised generation technologies (often combined heat and power) for their own needs.

Ecological solutions for niche markets

As some consumers favour "green power" specific niche markets for renewable energy technologies have emerged beyond the fields where they are economically competitive.

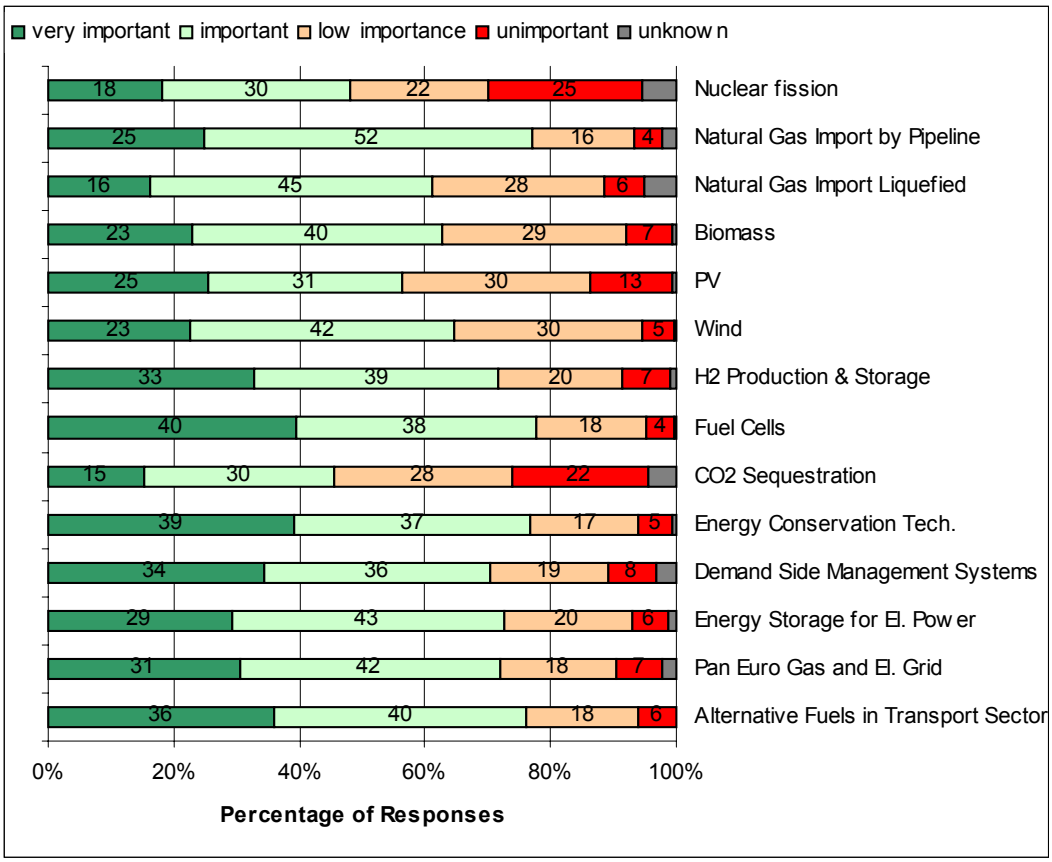
Growing transportation and mobility demands

Easy and cheap travelling *"Everybody can go where they want to"* and a rise in global trade *"world wide choice of goods"* lead to a growth in the transport sector and a corresponding energy demand.

Results of first round survey

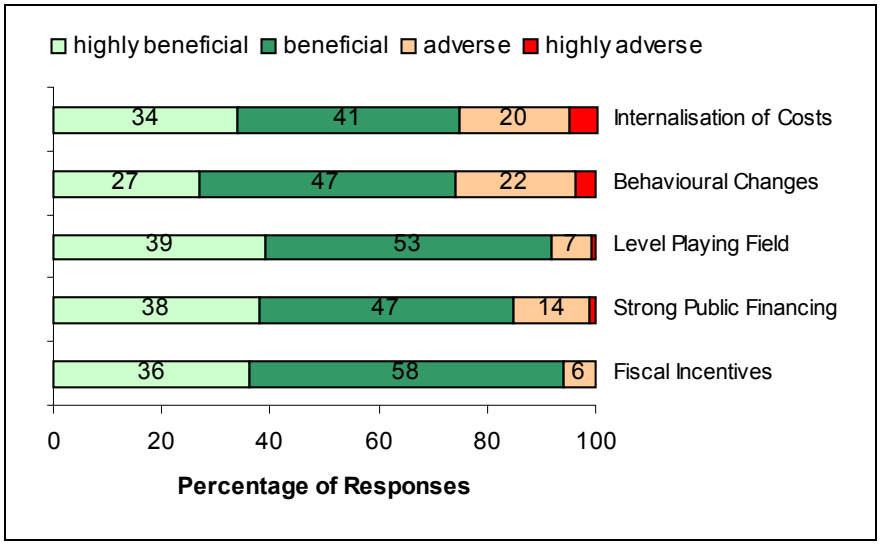
1.1 Energy sources and technologies

In order to support this vision of *individual choice*, how important are the following energy sources and technologies?



1.2 Instruments and Innovations

In order to support this vision of *individual choice,* how much influence would the following social, political, and economic instruments and innovations have?



2. Vision – Ecological Balance

The social vision

To live a life in balance with nature is the slogan that best describes the predominant European value in 2030. Accordingly the protection of the ecosystem is the major policy goal. It embodies both local (air quality, acid rain, etc.) and global (climate change, biodiversity, etc.) dimensions. The “polluter pays” principle is strictly enforced. Higher costs for ecological sound solutions are widely accepted by the consumers. This has led to the ‘greening’ of companies on the producer side.

Following the precautionary principle the use of resources and the emission of pollutants have been reduced dramatically. Industrial processes are being transformed into closed cycle processes.

Consequences for the energy sector

Strong push for energy technologies with low impact on nature

The choice of energy sources is made under the imperative of making the least possible impact on nature. Consequently renewables play an important and fast growing role in the energy supply. Diverse renewable energy resources are exploited according to their regional potentials. For these reasons, a mix of decentralized and centralized production/generation is employed.

Diversified sources of supply

In order to minimize the risk of endangering nature (and to be able to react reasonably quickly to new findings) there are no big “monocultures” which account for the majority of the energy supply. Instead the sources of energy supply are greatly diversified. In a transition period this allows (and calls for) an inclusion of energy sources which are not strictly renewable but which are supposed to have a low impact on the ecosystem.

Conservation of energy sources

Major improvements in energy efficiency have brought down the overall energy consumption. In combination with demand side management systems the improvements in energy efficiency form the basis for the high market share of renewables.

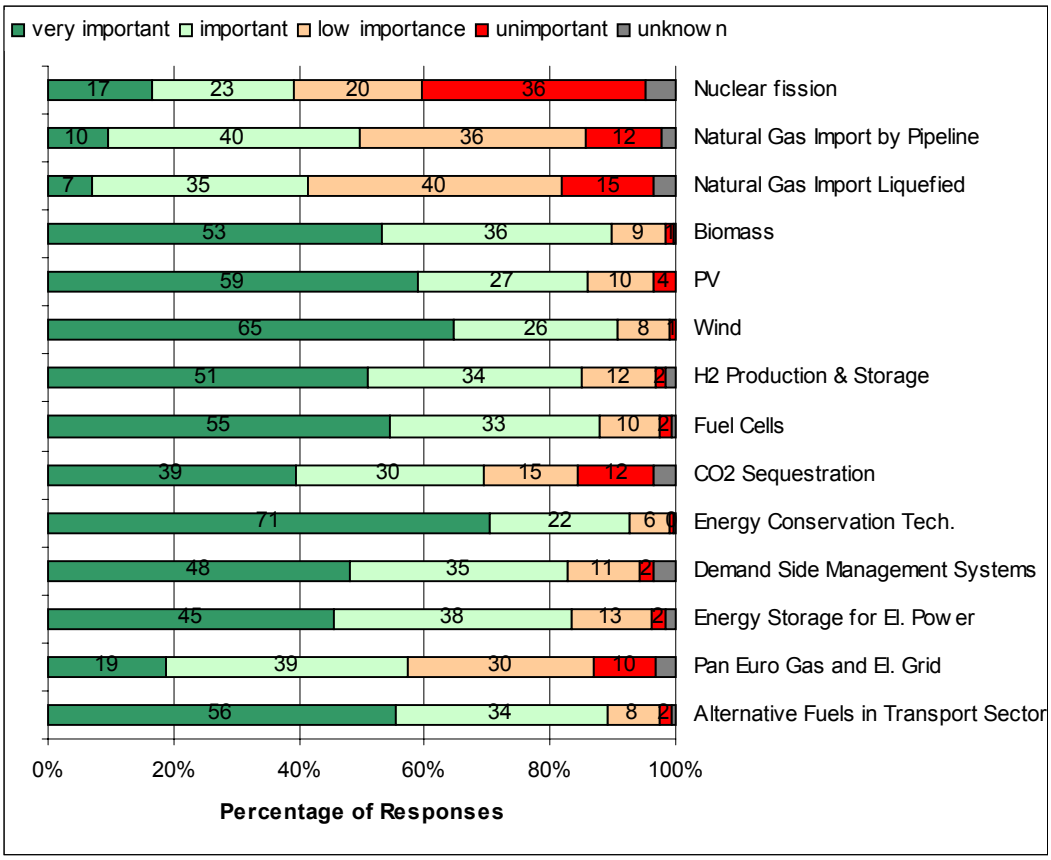
Local storage and long range transport of energy

Imbalances between demand and supply are countered by highly improved local storage systems (short and long term) as well as a European wide long-range energy exchange.

Results of first round survey

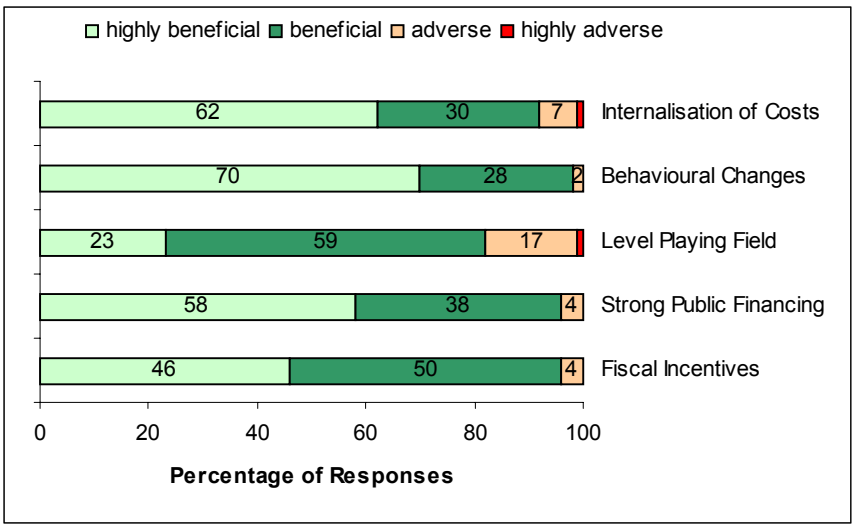
2.1 Energy sources and technologies

In order to support this vision of *ecological balance*, how important are the following energy sources and technologies?



2.2 Instruments and Innovations

In order to support this vision of *ecological balance,* how much influence would the following social, political, and economic instruments and innovations have?



3. Vision – Social Equity

The social vision

The pursuit of greatest possible equity is the primary value in Europe in 2030.

Consequently European policy strives to minimise income disparities and to combat social exclusion. The growth of the European Union, namely the accession of the middle and eastern European countries, raises the urgent need for establishing a social balance within Europe. To promote social cohesion within and between regions, European regulatory authorities set up a strong communal social framework, which explicitly allows for regional solutions.

In the private sector concepts of social accountability are widely applied. Responsible industries contribute their share to enhance the employment intensity of economic growth. Society is willing to socialize costs that go along with burden sharing and adopting measures that promote equity.

Consequences for the energy sector

Employment intensive technologies

Investments in the energy sector increasingly take local job creation effects into account. Technological choices in the energy sector are made in a way which foster the greatest job growth and thus mitigate income disparities.

Regional solutions – achieve added value

Energy production is built upon regional resources and needs. This leads to a high variation of approaches on the supply side. Policy regulation create a level playing field for all actors, at the same time allowing for protective measures which promote regional added value.

Decentralized generation owned by consumers

The energy system is decentralized to a high degree. Generation technologies (for both electricity and heating/cooling) are not only run locally but also owned locally. The former energy consumers have become producers at the same time – merging into prosumers. Demand/supply balancing is managed on a decentralized web basis. The legal framework is designed to allow easy access to technologies, resources, information and the electricity grid for all prosumers.

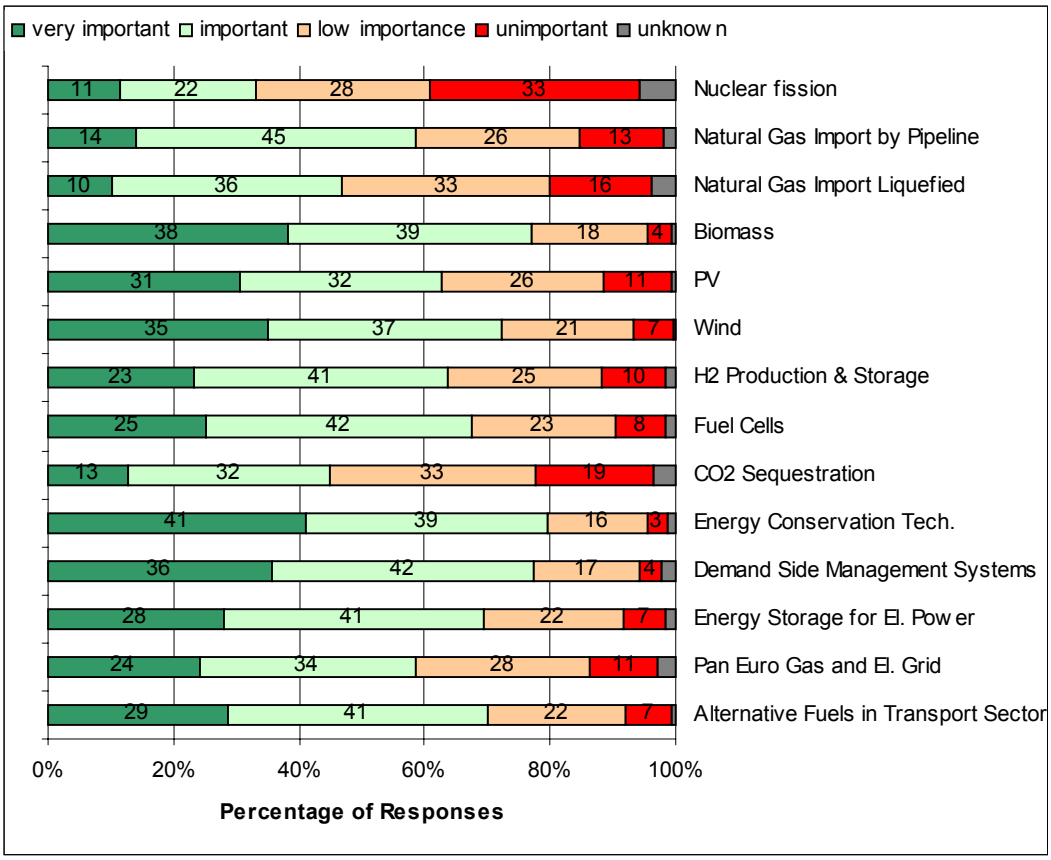
Equal burden sharing with low risk technologies

To promote an equal burden sharing a strong emphasis is put onto minimizing local risks of technologies (accidents and emission of pollutants). New technologies that are labelled to be risky, encounter a strong opposition. However, the potential of danger from technologies as perceived by the public is not the same as the actual (statistical) danger. This puts a high pressure on technologies, which bear the risk of major disasters (nuclear power plants, oil tankers) and on technologies, which have negative local effects (toxic pollutions, smells, etc.).

Results of first round survey

3.1 Energy sources and technologies

In order to support this vision of *social equity*, how important are the following energy sources and technologies?



3.2 Instruments and Innovations

In order to support this vision of *social equity,* how much influence would the following social, political, and economic instruments and innovations have?